Introduction to Astronomy
Exit Competencies
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Introductory Astronomy provides an ideal tool for teaching the nature of science and the scientific method. In particular, the changes in paradigms are well-known (e.g. geocentric vs. heliocentric models of the solar system) and the relationship between progress in science and invention of new technologies is clear. However, while the use of an astronomy course for teaching the nature of science necessitates teaching some basic physics concepts, it does not require specific subtopics within astronomy to be learned. The physics concepts that are essential to understanding the nature of science as taught in astronomy are:

(a) Newton's laws
(b) the nature of light (both waves and particles)
    (i) color, wavelength and energy
    (ii) Doppler effect
(c) electronic structure of atoms
(d) spectroscopy and the relationship between (b) and (c)
(e) blackbody radiation

In all cases, students should understand the concepts and the meaning of the equations but a rigorous mathematical understanding of formulae is not necessary (e.g. they should understand that the gravitational force between two bodies is proportion to the masses and inversely proportional to separation squared; the should understand that the nature of a blackbody is such that the total power output is proportional to both the size (radius) and the temperature of an object, but that the effect of temperature is stronger than that of size).

With this in mind, what follows is a list of those astronomical topics that are deemed essential to an astronomy course whose aim is to convey the nature and methods of science.

1. Students should understand how the motion of astronomical objects is viewed across the sky on various timescales (e.g. daily, monthly, yearly, etc.). Students should understand the manifestation of these apparent motions in terms of seasons and lunar phases. They should know the scientific relevance of the Zodiac constellations.

2. Students should know the properties of planetary motion as described by Newton's Laws and Kepler's Laws. They should know how these properties allow us to derive planetary (and in fact stellar) masses.

3. Students should know the fundamental measurable properties of stars, such as distance (where applicable), brightness, temperature, and derivable properties such as mass, radius, etc. They should know how those properties are derived. They should know what the Hertzsprung-Russell diagram is and what can be

represented on it. Star nomenclature (main sequence, giant, supergiant, dwarf, etc.) is also important

4. Students should know the hierarchical structure of the universe (solar system, galaxies, cluster galaxies, universe) and the methods of measuring astronomical scales (especially parallax and standard candles, but also Doppler shift and its relationship to Hubble's Law).

5. Students should know Hubble's Law and how it can be used to determine the history and probable evolution of the universe.